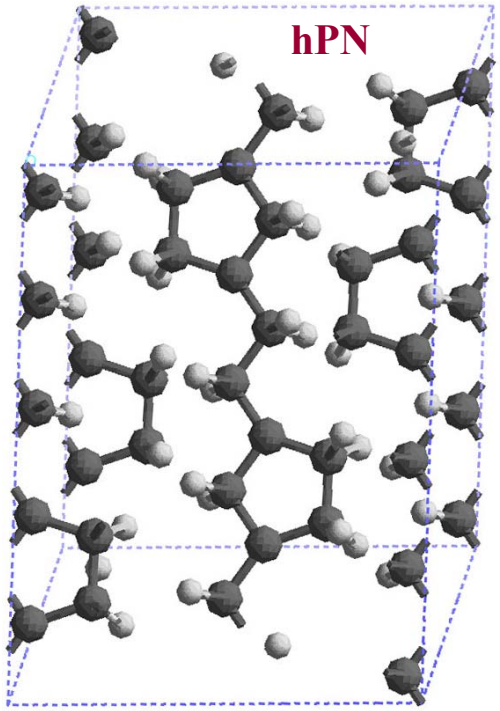
"Controlled Crystallization in Novel Block Copolymers"

Richard A. Register, Princeton University, DMR-0220236

Polymers derive their valuable properties from their structure, especially those polymers which can crystallize. Understanding and controlling polymer structure on a range of length scales thus permits the synthesis of materials with designed-in properties. A new crystallizable polymer, hydrogenated polynorbornene (hPN), has been synthesized by a versatile "living" polymerization chemistry (ROMP, bottom), which allows crystallizable hPN segments to be incorporated into a wide range of complex polymers. The average atomic-scale crystal structure of hPN is shown at near right (balls represent atoms), as derived from the fiber x-ray diffraction pattern (far right).



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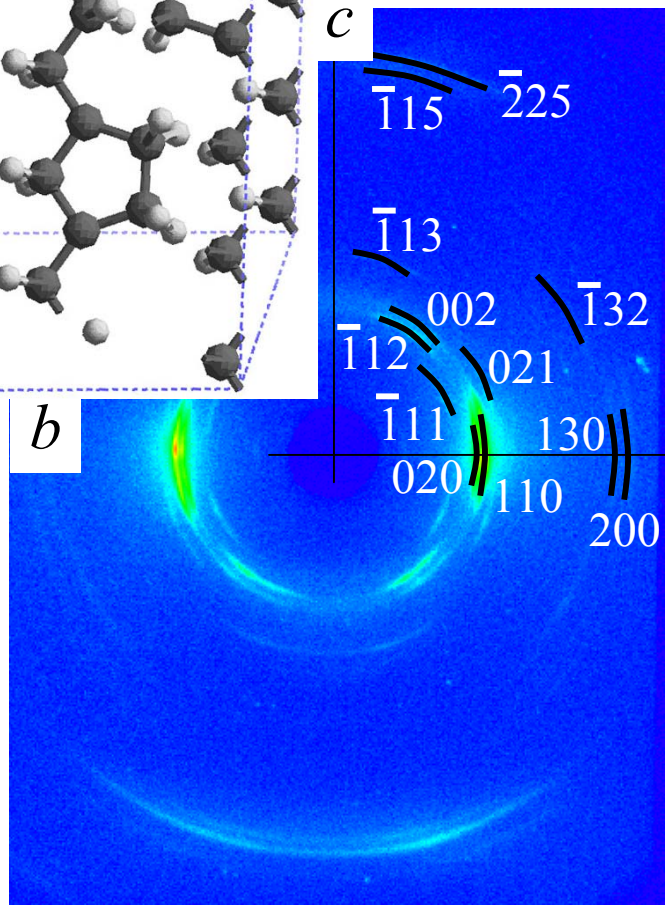
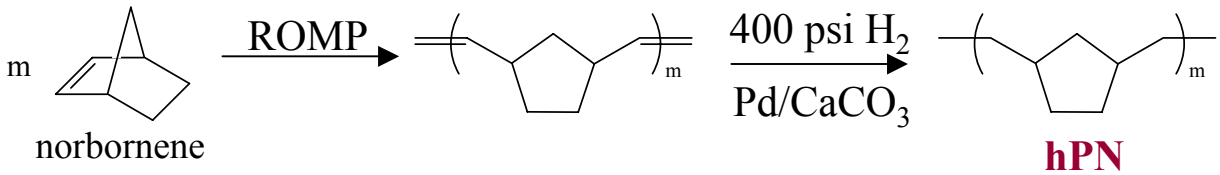
b = 9.60Å
c = 12.42Å
β = 130.7°





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Education and Outreach Highlights

Chinedum Enyinna '04 (below) investigated copolymerization of norbornene and alkylnorbornenes by "living" ring-opening metathesis polymerization (ROMP) during summer 2003 through a Research Experience for Undergraduates (REU) supplement to this award. The measured reactivity ratios indicate that copolymerization is nearly ideal (Bernoullian) for substituent chain lengths up to at least C_{10}. Chinedum is continuing his research this year for his B.S.E. thesis, mentored by Ph.D. students John Hatjopoulos and Sasha Myers.

Under the auspices of Princeton's QUEST program, developed a four-hour instructional module (lectures and hands-on activities) entitled "**Polymers: Stringlike Molecules, Rubbers, and Peculiar Liquids"** and presented this module to 15 Mercer County middle-school teachers in a workshop format at Princeton.

Delivered the three-hour short course "**Polymers: Introduction to the Structure and Properties of Stringlike Molecules**" to the 25 participants in the Princeton Center for Complex Materials' 2003 REU site program.